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On the Life History of *Meandrusa payeni* (BOISDUVAL) in Malaysia (Lepidoptera, Papilionidae)

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Preface

No information whatsoever of the early stages of *Meandrusa payeni* (Rhopalocera, Papilionidae) had been available since it was first described by J. B. A. BOISDUVAL in 1836 until the present author (1979) made public the morphology of its egg and larva up to the 4th instar. The life history of another representative of the genus, *M. sciron*, remains practically unstudied. As a result, the phylogenetic position of this genus has been rather vague. For instance, FORD (1944) and SHIRÔZU (1955) failed to refer to this genus in their classifications of the Papilionidae, while EHRLICH (1958), KUROSAWA (1958), MONROE (1960) and HANCOCK (1983) included it in the Leptocircini. The present author (1979) was the first to assign it to the Papilionini.

In 1969, Mr. Motohiro HARADA netted a female of *M. sciron* in Northern India, from whose ovipositor the author extracted a fertilized egg. It subsequently hatched and gave the author an opportunity of observing a 1st instar larva (not further). Similarly, an extracted egg from *M. payeni* caught by Mr. Yoshiaki GUNJI in Malaysia in 1978 hatched, and the larva grew up to the 4th instar. The data from only those two larvae were enough to give the author a rough idea of its nature, but he was not sufficiently convinced for want of data on mature larvae as well as pupae.

Recently, however, the author was blessed with an opportunity to see an ovipositing female of *M. payeni* in Malaysia. The eggs collected on the spot and the resulting larvae have revealed all the aspects of its early stages, as described and illustrated herewith.

The author is deeply grateful in completing this article to Dr. Takashi SHIRÔZU, Honorary President of the Lepidopterological Society of Japan (LSJ), Dr. Masami OGATA, President of LSJ, Dr. Yoshihiko KUROSAWA of LSJ, Prof. Toshitaka HIDAKA of Kyoto University, Prof. Shigeru A. AE of Nanzan University, Prof. Toyohei SAIGUSA of Kyushu University, Mr. T. G. HOWARTH and Mr. C. G. C. DICKSON for their valuable advice, to Professor Emeritus Sumihiko HATSUSHIMA of Kagoshima University, for the identification of plant specimens. His wife Yoshiko's participation in field surveys in Malaysia was also worthy of thanks.

Fig. 1. The site where oviposition of *Meandrusa payeni* was observed (See text).

Life History

1. Adult habits

Both sexes of *Meandrusa payeni* fly very rapidly, rather erratically as some of the *Graphium*-species do. Males come to puddles for drinking, but no female was seen doing so. Flowers are visited by both. When drinking or sitting, they fold their wings.

2. Number of broods

On the Malay Peninsula, the adults are on the wing uninterruptedly from May till December, and no seasonal forms are known. In Northern India, however, small specimens considered to be the spring form are in striking contrast to large, darkish specimens which are regarded as the summer form.

3. Courtship and mating

No field observation of either behaviour kind has been made by the author.

4. Ovipositing behaviour

The author spotted a female of *Meandrusa payeni* laying eggs at 1.45 p.m., June 25th, 1987, in Central Malaysia (Fig. 1). It was fluttering about two roadside trees of 7 to 9 metres in height at a point about 17 miles from Tapah in the direction of Tanah Rata. It was engaged in the activity for nearly ten minutes, alighting on leaves of branches above the road.

Its behaviour resembled that of a *Graphium* butterfly. It touched a leaf while

beating its wings rapidly, and laid an egg on the underside of the leaf near the edge. After laying one egg, the butterfly resumed a rapid flight around the trees, and after 30 to 60 seconds laid another egg. The sprigs were examined later and produced 13 freshly laid eggs. It is noteworthy that all the leaves with eggs were coarse, mature ones rather than buds or fresh leaves. It was the only instance of oviposition in nature that was observed.

5. Oviposition in captivity

On April 5th, 1986, Mr. CHONG Kia Kwang, an insect dealer in Tapah, kindly gave the author a live female of the same species. Unfortunately, it was rather weak from hunger. It did manage to feed on honey and water. When leaves of *Litsea cubeba* (Lauraceae) was introduced into the polyethylene bag containing the butterfly, it bent its abdomen several times as if to lay eggs, but without further development. The test was encouraging, however. A more healthy female treated similarly will probably lay eggs in captivity.

6. Foodplants

The tree on which the butterfly was laying eggs was indentified as *Litsea cubeba* (LOUR.) PERS. (Lauraceae). It is also found in Southern Japan (Plate 3-8 – 11). In Japan, larvae were also given on an experimental basis leaves of other lauraceous plants including *Cinnamomum camphora* and *Machilus thunbergia*, and of *Desmos chinensis* (Annonaceae, from Malaysia). They nibbled at them at first but soon lost interest in them. *Sassafras randaiense* (Lauraceae, from Taiwan) was much preferred but the larva which fed on it soon died. *Lindera umbellata* var. *membranacea* proved to be a tolerable substitute foodplant in Japan, on which larvae fed until pupation. The resulting pupae and imagines were undersized.

7. Early stages

(as observed at the Cameron Highlands, Malaysia [alt.: 1,400m])

Egg: the egg stage lasted 11 days at 28℃, which was equal to the average temperature at the haunt. The period is rather long in comparison with the case of other Papilionids.

Larva: rearing was done under the same temperature. The 1st instar took 5 to 6 days to complete, the 2nd instar 7 to 9 days, the 3rd instar 7 to 11 days, the 4th instar 12 to 17 days, and the 5th (final) instar from 14 to 22 days. The duration of an instar tends to become longer as the larva grows older, and the 5th instar larva requires two to three weeks to mature. The slow growth of the final instar larva is ascribed to its reserved appetite, so that it excretes only a dozen pellets or so a day. Wild larvae were found at great heights of foodplant, just as eggs were laid on similar levels. The larva is solitary, sitting on a silk pad spun on the upperside of a leaf. It strongly sticks to the seat leaf; no matter how far it goes to feed, it always returns to the same leaf after a meal. It walks and moves only very slowly, and will not extrude its osmeterium by a moderate stimulus.

Pupa : an empty pupal case was found on a foodplant at a height of 7 metres from the ground. It was on a pad of silk spun on the upperside of two adjoining leaves. The larvae were reared in sleeves on a growing foodplant where they pupated. Without an exception, the larvae pupated on the upperside of leaves, never on the underside, twigs or the sleeve. This unusual pupating habit is unknown in other Papilionid species. The dark green colour of the pupa is proof that it normally pupates on the upperside of a leaf (Plate 3-6, 7).

Another peculiar feature is that the mature larva draws a leaf adjacent to its seat leaf and connect them with silk, as if to broaden its abode. Mature larvae of some *Graphium*-species, which usually pupate on leaves (underside), spin a lot of silk on the leaf stalk and twig for security, but *M. payeni* does not strengthen the leafstalk prior to pupation.

Morphology

Egg : almost spherical, with the bottom slightly concave ; pale yellow with a suggestion of green and half glossy ; 1.85mm in diameter and 1.7mm in height.

First instar larva : head glossy dark brown, 1.25mm accross and provided with black setae ; osmeterium milky white ; prothoracic plate yellowish brown, with a yellowish orange blunt-tipped, hairy process on each side ; body yellowish brown, with a white dorsal line running from the prothorax to the anterior half of the 9th abdominal segment ; the dorsal line bordered by a pair of cactiform processes on each segment, each accompanied by a hair diagonally behind ; one large cactiform process on the supraspiracular line on each of the mesothorax and the metathorax ; 3rd abdominal segment with a large white lateral patch reaching the subdorsal line on either side, extending subdorsally into the 4th abdominal segment ; 8th abdominal segment also with marbled white lateral patches which fuse dorsally along its posterior margin ; one large cactiform subdorsal process on each of the 9th and 10th abdominal segments ; anal plate not clearly defined and provided with three pairs of setae ; thoracic legs dark brown ; prolegs and anal legs pale yellowish brown.

Second instar larva : head 1.82mm wide, glossy yellowish green, but its upper half yellowish brown ; head setae black but upper ones reduced to only sockets ; osmeterium milky white ; prothoracic plate glossy yellowish brown, tipped with a bullet-form process on each side ; no setae present on the plate or processes ; body glossy yellowish brown ; dotted throughout with minute depressions, which are particulaly numerous dorsally from the mesothorax to the 2nd abdominal segment ; metathorax with one light blue spot each on the subdorsal and spiracular lines ; 1st abdominal segment with a similar spot on the subdorsal line ; 3rd abdominal segment almost covered with a white lateral patch, which extends upwards towards the posterior margin of the segment where the right and left patches are connected, downwards towards the basal line of the 1st abdominal segment via the area between the subspiracular and basal lines of the 2nd abdominal segment, and also posteriorly towards the subdorsal line of the 4th segment, where the patches contact with each other along the anterior and
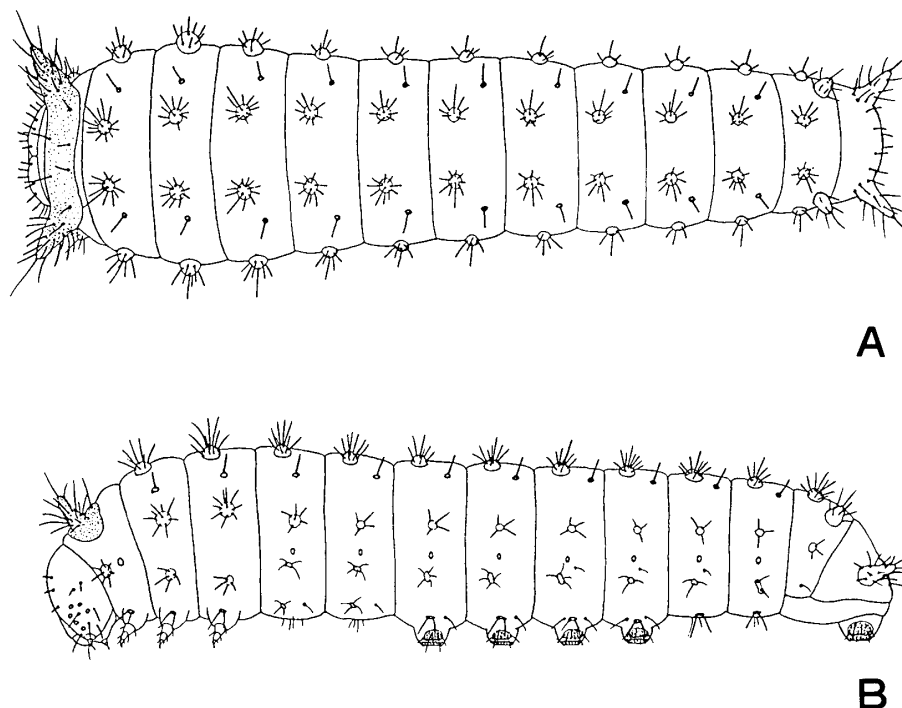
Fig. 2. First instar larva of *Meandrusa payeni*. A. Dorsal aspect; B. Lateral aspect.

posterior margins; 8th abdominal segment saddled with an anchor-shaped white mark, which extends downwards towards the subspiracular line along its posterior margin; anal plate glossy yellowish brown and devoid of setae; basal line pale yellowish green from the 1st abdominal segment to the tail end; tail ended square in dorsal aspect; thoracic legs glossy pale yellowish brown; prolegs and anal legs greyish brown.

Third instar larva: head 2.63 mm wide, glossy pale green with minute yellowish brown points densely dotting the upper half; osmeterium milky white; prothoracic plate glossy yellowish green, with a small projection on each side; body roughly the same in colouring and markings but differs from the previous instar larva as follows; appearance of a pair of indistinct red dorsal spots on the latter half of the 1st abdominal segment, development of a small low lobular dorsal growth on the posterior margin of the same segment, expansion of the white area on the 3rd and 4th abdominal segments and greening of the 2nd to 7th abdominal segments; dorsal aspect of the caudal end more distinctly square, which assumes a bright green colour; anal plate glossy yellowish brown; thoracic legs glossy pale olive; prolegs and anal legs greyish brown; body colour dividing into two types-brown (Plate 2) and green (Plate 3-3).

Forth instar larva: head 3.46 mm, otherwise the same as in the previous instar; prothoracic plate glossy yellowish brown with a small wart-like process at each end; upper half of the thorax and 1st abdominal segment yellowish brown, dotted with dark brown points; one small white spot on each of the subdorsal and supraspiracular lines on the 3rd abdominal segment; subdorsal pair of red spots on the posterior half of the

1st abdominal segment more pronounced than in the previous instar and longitudinally interspersed with two X-shaped black marks ; each red spot margined on the dorsal side with a long elliptic black spot ; lobular dorsal growth on the posterior margin of the same segment larger than before ; 2nd to 8th abdominal segments more distinctly green ; white lateral areas on the 3rd and 4th abdominal segments more extended ; 6th, 8th and 9th abdominal segments yellowish brown dorsally ; anchor-shaped white dorsal mark on the 8th abdominal segment still present as in the previous instar ; anal plate glossy brownish orange ; basal line white but bright green around the square caudal end ; prothoracic legs glossy greenish brown ; prolegs and anal legs greyish white ; body colouring in two types of brown (Plate 2) and green (Plate 3-4).

Fifth (final) instar larva : head 5.49 mm wide, pale green with a dull lustre, yellowish at top, generally covered with short colourless hair ; osmeterium milky white ; prothoracic plate bright yellow, thinly margined with black posteriorly and with a short wart-like projection on each side ; body greyish green, sparsely dotted with minute dome-shaped growths (Fig. 3) ; thorax remarkably dilated ; 1st abdominal segment postreiorly traversed by a pale yellow dorsal belt, which is thinly mottled with black and bears a pair of black lunules in the middle ; each lunule in contact with an indistinctly delineated pale red round spot, which contains a small white spot on its posterior margin ; posterior part of the dorsum of the 1st abdominal segment strongly raised backwards ; wide but poorly delineated greyish white bands originating laterally in the 2nd abdominal segment converging dorsally on the 4th abdominal segment and partially extending into the anterior margin of the 5th abdominal segment ; posterior part of the dorsum of the 8th abdominal segment on to the caudal end greyish white with a slightly greenish hue ; lower half of the body uniformly greyish white ; prothoracic legs pale green ; prolegs and anal legs greyish white.

Pupa : head without conspicuous projections, and slightly arched in dorsal aspect, laterally ending in a sharp point ; prothorax and mesothorax with a grey V-shaped ridge on the dorsum, and also grey ridges beside the spiracles ; mesothorax with a short beak-shaped projection bending backwards and ending in a short, pointed fork ; dorsum behind the projection deeply concave and fringed with a grey ridge ; an acute lateral ridge, grey in colour, starting from a small grey point on the subdorsal line of the metathorax, runs along the posterior edge of the forewing, and then, turning yellow, along the basal line from the 4th abdominal segment onwards ; one wart-like dorsal process each on the 1st and 2nd abdominal segments, the first one being anteriorly accompanied by a distinct glossy black point ; a wide grey dorsal belt margined with dark brown from the 3rd abdominal segment to the caudal end ; the belt flanked by a total of three pairs of well-developed processes on the 5th to 7th abdominal segments ; process on the 5th segment trapezoidal in lateral aspect, while the others are thin, tapering and bending forward ; proboscis ending just short of the posterior margin of the 4th abdominal segment ; fore and mid legs mostly exposed ; wing case sprinkled with numerous small white spots ; abdominal segments brightly green except for the grey dorsal belt and yellowish subdorsal and ventral areas ; ventral side of the abdomen flat, matching the leaf surface, in great contrast to other
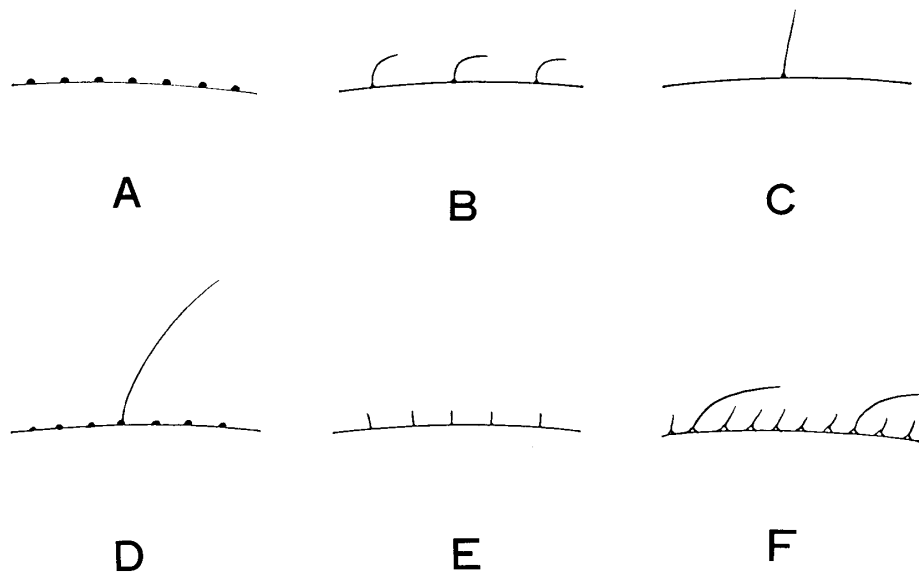
Fig. 3. Conditions of body surface of the final instar larvae in Papilionidae. A. *Meandrusa payeni* ; B. *Menelaides helenus* ; C. *Teinopalpus imperialis* ; D. *Graphium sarpedon* ; E. *Papilio xuthus* ; F. *Atrophaneura alcinous*.
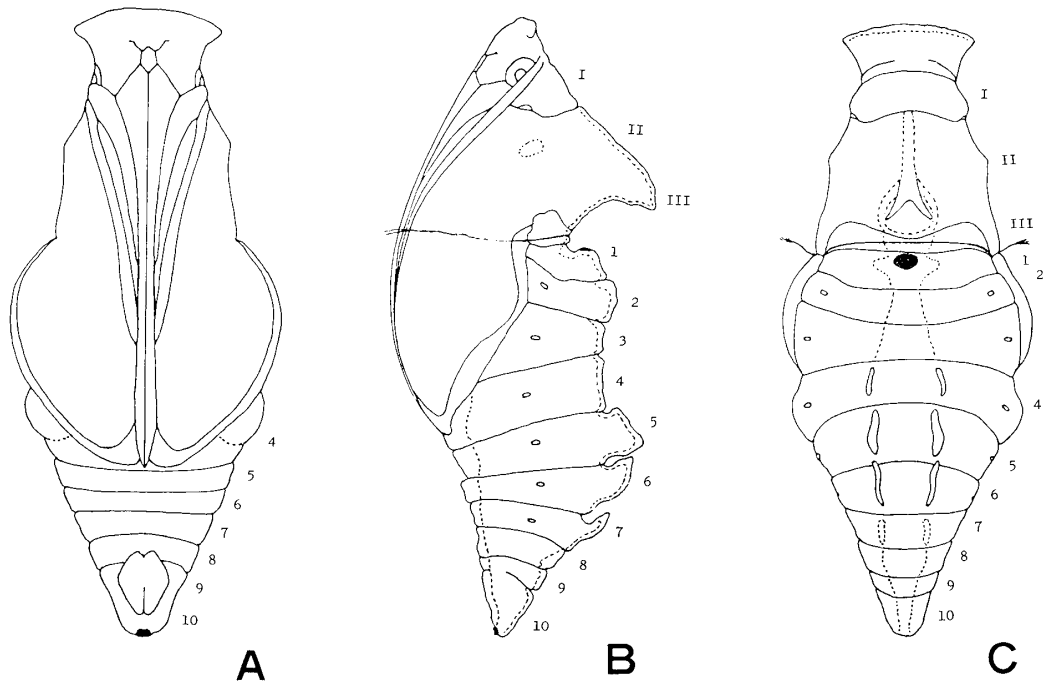
Fig. 4. Pupa of *Meandrusa payeni*. A. Ventral aspect ; B. Lateral aspect ; C. Dorsal aspect.

Papilionid species pupating on twigs and undersides of leaves ; body length averaging 37 mm (Fig. 5).
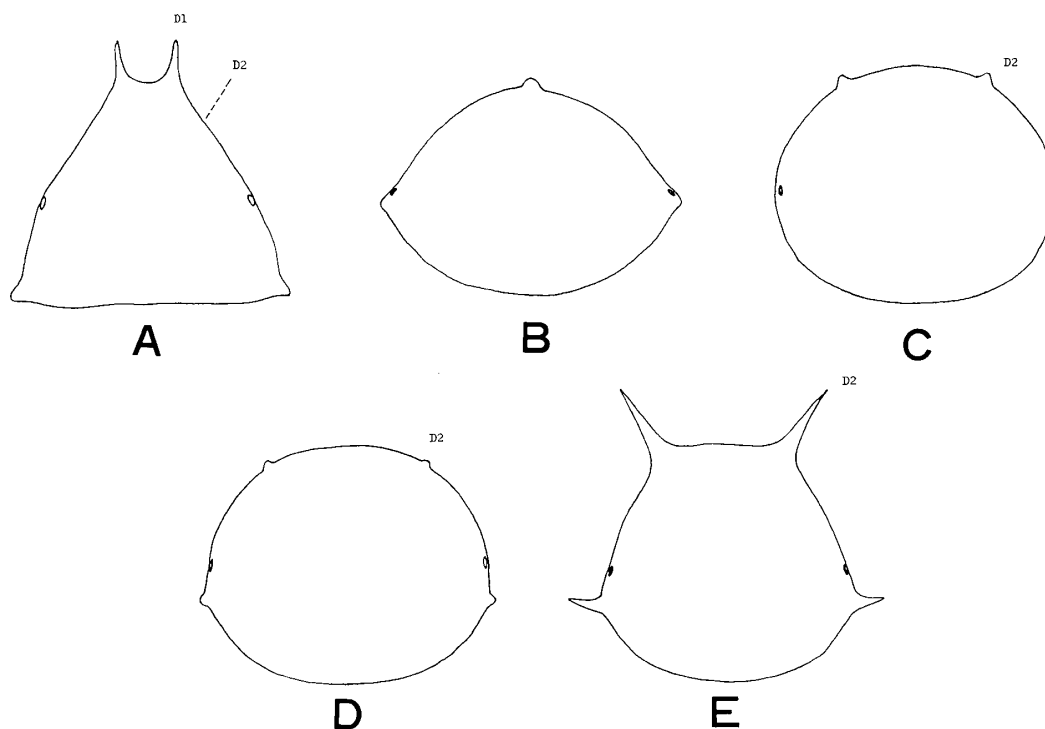
Fig. 5. Cross-sections in the posterior area of fifth abdominal segment of Papilionid pupae. A. *Menelaides*; B. *Achillides*; C. *Papilio*; D. *Graphium*; E. *Atrophaneura*.
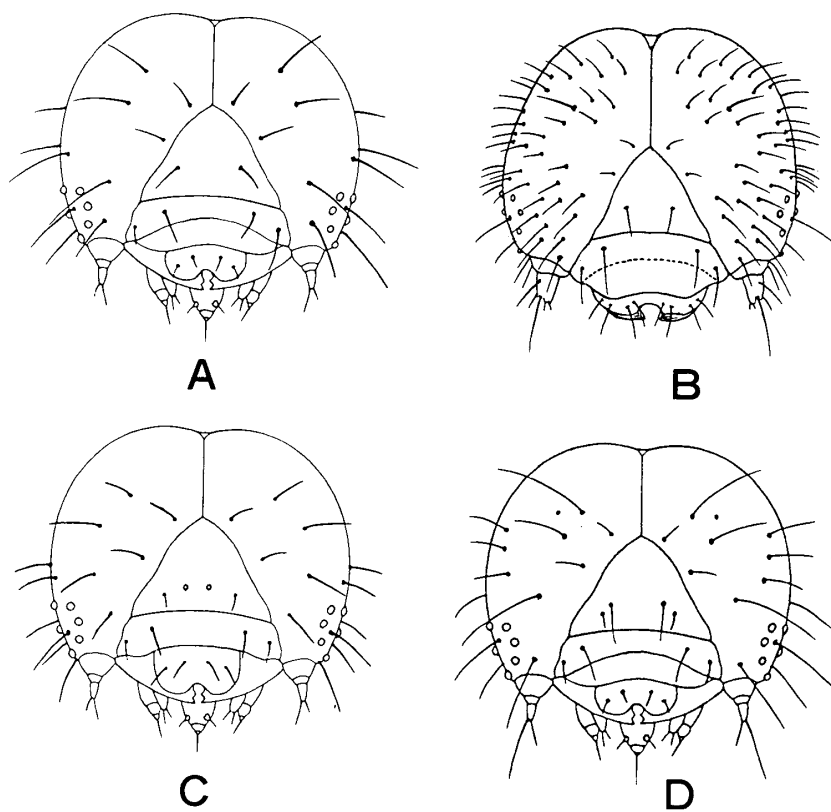
Fig. 6. Head chaetotaxies in first instar papilionid larvae. A. *Meandrusa payeni*; B. *Menelaides protenor*; C. *Graphum sarpedon*; D. *Teinopalpus imperialis*.
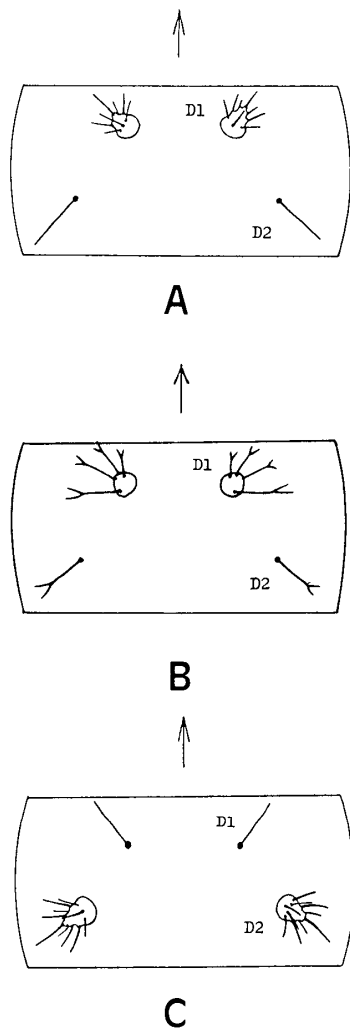
Fig. 7. Tubercles and setae on the dorsal area of abdominal segments in first instar larvae of papilionid genera. A. *Meandrusa*; B. *Graphium*; C. *Papilio, Menelaides, Achillides*.
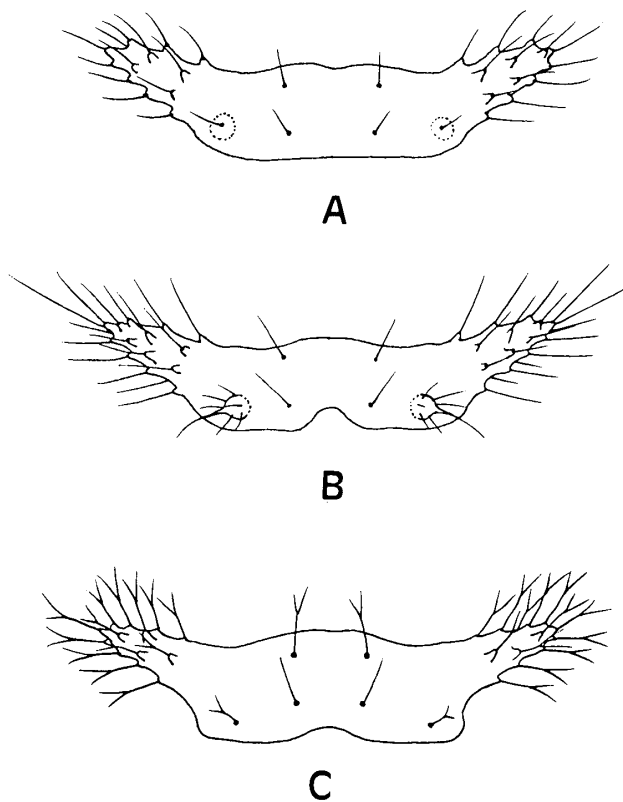
Fig. 8. Prothoracic shields in first instar papilionid larvae. A. *Meandrusa payeni*; B. *Achillides bianor*; C. *Graphium sarpedon*.

Evaluation of features

(P means a feature close, common or similar to those in the Papilionini; L likewise stands for Leptocircini; Sp, a specialized feature)

Habits

1. *M. payeni's* foodplant belongs to the Lauraceae, which include the host plants of numerous Leptocircini. Only such butterflies of the Papilionini as *Chilasa* and *Agehana* species as well as North American *Papilio troilus* and *P. paramedes* feed on lauraceous plants.
   In this respect, *M. payeni* is an exceptional case. (L)
2. The larve walks without rocking motion. (P)
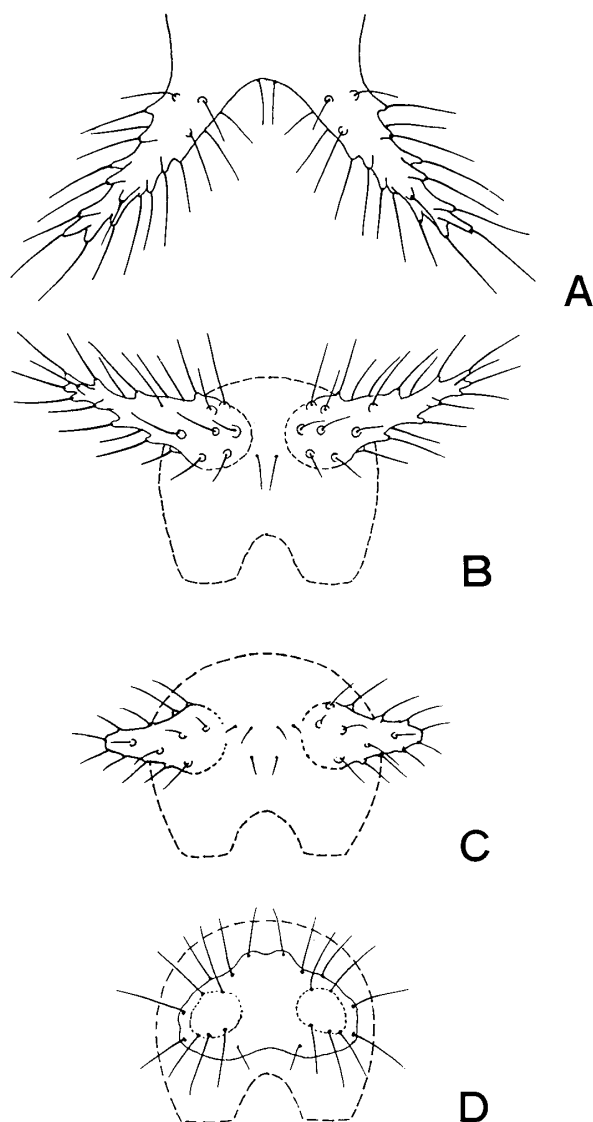
Fig. 9. Anal plates in first instar papilionid larvae. A. *Graphium doson*, dorsal aspect ; B. *Ditto*, posterior aspect ; C. *Meandrusa payeni* ; D. *Achillides bianor*.

3. The larva strongly sticks to its seat leaf. (L)
4. The osmeterium is not easily everted. (Sp)
5. Pupation takes place on the upper surface of leaves, which is a unique feature. (Sp)
6. The durations of the egg stage and the final larval instar are exceptionally long. (Sp)

Morphology

1. First instar larva

General colouring and markings, particularly the white saddle mark over the 2nd to 4th abdominal segments, resemble those of *Papilio*-species. (P)

The number and arrangement of the head setae belong to the primitive chaetotax-

y. (L) (Fig. 6)
The prothoracic plate is well defined. (P) (Fig. 8)
On the dorsum, cactiform processes are exteriorly accompanied by hairs. (L) (Fig. 7)
The setae are not bifid. (P) (Fig. 8)
The anal plate has lateral projections. (L) (Fig. 9)
The anal plate is indistinctly defined. (L) (Fig. 9)
The osmeterium is white. (Sp)

2. Second to fourth instar larvae
Head setae degenerate except in the lower half. (Sp)
Processes on the body are lost. (Sp)
Minute dents appear on the body. (Sp)
The overall colouring and markings are as in *Papilio*. (P)
Light blue or white spots are found on the thorax and the 1st adbominal segment. (P)
The white diagonal belt on the 2nd to 4th segments (saddle mark) is as in *Papilio*.
The osmeterium is white. (Sp)
The upper part of the anal leg projects and tapers sideways. (Sp)

3. Fifth (final) instar larva
The prothoracic plate is bright yellow. (Sp)
The 1st abdominal segment is traversed by a belt. (P)
The upper part of the anal leg projects and tapers sideways. (Sp)
The osmeterium is white. (Sp)
The body skin is sparsely strewn with minute dome-shaped growths.

4. Pupa
The crown of the head is devoid of projections. (L) (Fig. 4)
The mesothoracic dorsal process is bent backward. (Sp)
The mesothoracic process is bifid at top. (Sp)
There is a deep depression behind the mesothoracic process. (Sp)
The subdorsal rows of processes are homologous to the D1 processes of the 1st instar larva, and not to the D2 processes as in other species of Papilionini. (Sp) (Fig. 5)
The antennae, fore and mid legs are arranged as in Papilionini. (P)
The ventral side from the 4th abdominal segment onwards forms a flat plane. (Sp)

Conclusion

Some of the above-mentioned features of the butterfly's early stages suggest its proximity to the Papilionini, and others to the Leptocircini, but there are also characteristics found in Papilionid species other than the Papilionini and the Leptocircini. It is therefore difficult to judge whether *Meandrusa* belongs to the Papilionini or otherwise.

As the larva grows older, unique features unknown in either group increase in

number, and the pupa is without a peer.

It can be safely said that, as far as its early stages are concerned, *Meandrusa* may well be a tribe that had branched off the "main stream" of the Papilionidae befoer the differentiation of the Papilionini and the Leptocircini.

The 1st instar larva of *sciron*, the other known species of this genus, had exactly the same features as those of *payeni*.

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摘　　要

マレーシアにおけるカギバアゲハの生活史 (五十嵐　邁)

序　　文

Meandrusa payeni カギバアゲハは1836年にBOISDUVALによって記載されて以来, 筆者 (1979) が4齢までの幼虫の形態を記録するまでその幼生期についてはまったく知見が得られなかった. 属*Meandrusa*には他にもう1種*sciron*ギアスアゲハが知られているが, やはりその生活史の手がかりは今日まで摑めていない. 生活史が解明されないため, 本属の分類学的位置についてもあまり決定的な説が立てられないままにすぎて来た感がある. 本属の所属についてFORD (1944), 白水 (1955) は触れておらず, EHRLICH (1958), 黒沢 (1958), MUNROE (1960) はいずれもLeptocircini, 五十嵐 (1979) はPapilionini, HANCOCK (1983) はLeptocirciniにそれぞれ含めている. これを見て判るとおり, ほとんどすべての研究者の説はLeptocirciniに含めているが, 筆者はこれをPapilioniniに移した.

それは1969年に北インドにおいて原田基弘氏採集になる *M. sciron* の♀から筆者が絞り出すことによって得た1卵から孵化した1齢幼虫だけを見ることができたこと, また1978年マレーシアにおいて郡司芳明氏によって得られた*M. payeni*の卵を絞り出し, 孵化した幼虫を飼育して1齢から4齢までの幼虫を検する機会に恵まれたことによって新しい考え方を抱くことができたからである. 残念ながらこれら2頭の幼虫はいずれも蛹化には成功しなかったので, 自説にたいして強い自信を抱くには至らなかった. 幸い今回マレーシアにおいて自然の状態のもとで*M. payeni*カギバアゲハの産卵に遭遇する好運に恵まれ, その生活史が明らかになったのでここに発表する. 発表にあたり日頃ご指導を賜わる日本鱗翅学会名誉会長白水隆博士, 日本鱗翅学会会長緒方正美博士, 日本鱗翅学会会員黒沢良彦博士, 京都大学教授日高敏隆博士, 南山大学教授阿江茂博士, 九州大学教授三枝豊平氏, T. G. HOWARTH氏, C. G. C. DICKSON氏, 食餌植物の同定をお願いした鹿児島大学名誉教授初島住彦博士の諸氏に深甚な謝意を表する. 探索に同行協力した妻昌子の労をも多とする.

生　活　史

1．習　性

♂♀ともに飛翔はきわめて敏速で，*Graphium*に似た跳躍式である．♂は吸水に湿地に下りるが♀の吸水は観察されていない．♂♀ともに吸蜜に花を訪れる．吸水，静止の折は翅を背の上にたたむ．

2．発生回数

マレー半島では1～4月をのぞいて連続的に発生をくりかえし，季節型らしいものはみとめられない．インド北部で得られる標本には明らかに春型と考えられる小型のものと，夏型と考えられる黒色部の発達した大型のものとがみとめられる．

3．求愛行動および交尾

観察の機会に恵まれていない．

4．産卵行動

筆者は1987年6月25日午後1時45分，マレー半島中部のTapahよりTanah Rataへ向かって約17マイル入った標高約700 mの地点において道路沿いに茂る高さ約7～9 mの2本の食餌植物に飛来した1♀が産卵するのを発見した．蝶は約10分間にわたり，路上に突出した枝に次々と産卵した後に飛び去った．

産卵習性は*Graphium*に似て，こまかく翅をふるわせながら葉にとまり裏面の外縁部に1個を産みつけるやただちに飛び立ち，約30～60秒間食餌植物の周囲を敏捷に飛びまわった後，ふたたび産卵をくりかえした．後刻この2本の木を調べたところ計13個の卵を発見した．卵はいずれも若芽，若葉でなく，成熟した固い葉に産付されていた．産卵に関してはこれが唯一つの観察例である．

5．人工採卵

1986年4月5日，マレーシアのTapahの標本商CHONG Kia Kwang氏より生きた1♀が贈られたが，すでに何日かを給蜜することなく経過していたのでいちじるしく衰弱していた．この個体に充分蜜を吸わせたのち現地に自生している*Litsea cubeba*アオモジ(Lauraceaeクスノキ科)を与えたところ，明らかに産卵意欲を示して再三にわたり腹部を曲げたがついに産卵にはいたらなかった．この事実から，健康な♀を用いれば人工採卵はさほど困難ではないものと想像される．

6．食餌植物

マレー半島においては*Litsea cubeba* (LOUR.) PERS. アオモジ(クスノキ科)を食うことが筆者により確認された．アオモジは日本でも九州以南に分布する(Plate 3-8－11)．*Cinnamomum camphora*クスノキ(クスノキ科，日本産)，*Machilus thunbergia*タブノキ(クスノキ科，日本産)，*Desmos chinensis* (バンレイシ科，マレーシア産)を与えたところほんの少量を食ったが，やがて食わなくなった．*Sassafras randaiense*タイワンササスラス(クスノキ科，台湾産)はかなり多量に摂食したがまもなく死亡した．*Litsea umbellata*クロモジの1型var. *membranacea*オオバクロモジ(クスノキ科，日本産)を与えたところ，よく摂食して蛹化にいたったが，羽化した成虫はやや小型であった．

7．幼生期の生態

Cameron Highlands (標高1,400 m)で飼育した．

卵：産卵現場の平均気温に合わせて人工的に28℃に保った結果，卵期は11日であった．アゲハチョウ科の他属の種にくらべて卵期が長い．

幼虫：同じ温度で飼育を続けたところ1齢期は5～6日，2齢期は7～9日，3齢期は7～11日，4齢期は12～17日，5齢期は14～22日であった．成長するにしたがって齢期が長くなり，とくに終齢期が著しく長い．これは1日当りの摂食量が少なく，10数個の糞しか排泄しないことに起因すると考えられる．また終齢期間は個体による差異が大きい．

卵が食樹の高い位置に産付されるせいか，幼虫も同様高い位置で発見された．幼虫は単独に，葉の表面に糸を吐いて台座をつくり，これに静止する．非常に台座に固執する習性が強く，摂食時はかなり離れた別の枝に出かけるが，摂食を終るともとの台座に戻る．動作はきわめて遅鈍である．かなりの刺激を与えても容易に肉角を出さない．

蛹：自然状態における蛹化は地上約7mの食樹上で行なわれたもの1頭(脱殻)が野外で発見された．この個体は2枚の葉を引き寄せてその表面に糸を吐いて台座をつくり，ここに蛹化したものであった．飼育した幼虫は食餌植物に袋がけをして，その中で蛹化させたが，どの個体もすべて葉の表面で蛹化し，葉の裏面，枝もしくは袋の内側に付着したものは1例もなかった．この習性はアゲハチョウ科の他種に見られぬ特異な習性である．蛹の体色が暗緑色を呈するのも，食樹の葉の表面の色に似たものとも考えられよう(Plate 3-6, 7)

蛹化習性について，もう一つの特異な点は蛹化の折，幼虫がしばしば隣接するもう1枚の葉を引き寄せて，その一部を重ねて表面に糸を張り蛹化の座とする習性である．同じく葉に蛹化する習性の強い*Graphium*は，蛹化に際して老熟幼虫は葉柄に多量の糸を巻きつけるが，本種にはこの習性がなく，幼虫通過時の通常の吐糸が観察されただけである．

8．形　　態

卵：形はほぼ球形で，底面は曲面をなして浅く凹む．色はわずかに緑色味をおびた淡黄色で，表面に半光沢がある．直径は約1.85 mm，高さは約1.70 mm.

1齢幼虫：頭部は黒褐色で光沢があり，黒色毛を生じる．頭幅は約1.25 mm．肉角は乳白色．前胸背板は黄褐色で，左右両端には1本の黄橙色の突起がある．突起は先端が丸く，淡黄色の毛を生じる．胴部は黄褐色で第1胸節から第9腹節前半部にかけて背線上に1本の白線が縦走する．背線の両側には各節1対のサボテン形突起があり，その外側斜後方に1本の常形毛を生じる．第2，3胸節気門上線上にはそれぞれ1本の大きなサボテン形突起がある．第3腹節側面にはほぼ全域を覆う白色の大紋があり，同節の亜背線に達するが背面で左右合一するに到らない．この斑紋は亜背線上において第4腹節に侵入する．第8腹節側面にも粗い白色斑紋が存在し，これは同節背面の後縁を広く縁どって左右合一する．第9，10腹節亜背線上には各節1本の大形サボテン形突起が存在する．肛上板は輪郭が不明瞭，3対の刺毛を生じる．胸脚は黒褐色で光沢がある．腹脚および尾脚は淡黄褐色を呈する．

2齢幼虫：頭部は淡黄緑色で光沢があり，上半部は黄褐色を呈する．頭部刺毛は黒色であるが，下部のものを残してほとんどが刺毛本体が退化し，基部のソケットだけが残存している．頭幅は約1.82 mm．肉角は乳白色．前胸背板は黄褐色で光沢があり，左右両端には小さい砲丸形の突起がある．突起も含めて板上には刺毛はまったく存在しない．胴部は黄色味をおびた褐色で光沢が強い．体の全域，とくに第2胸節～第2腹節の背面には小さな凹みが多い．第3胸節亜背線ならびに気門上線上，第1腹節亜背線上にはそれぞれ1個の水色の小円紋を装う．第3腹節側面にはほぼ全域を覆う白色の大紋があり，同節の背面に伸びて，後縁部でようやく左右合一する．この斑紋の底部は前方の第2腹節気門下線，基線に拡がり，さらに第1腹節の基線に達する．一方，この白紋は後方では第4腹節亜背線上に伸び，同節の前縁と後縁の2個所で左右接続する．第8腹節背面には白色の錨形紋1個を装い，その一部は同節後縁に沿って気門下線付近まで下降する．肛上板は黄褐色で光沢があり，刺毛を生じない．第1腹節から尾端までの各節基線は淡黄緑色を呈する．背面から見ると尾端は四角く突出する．胸脚は淡黄褐色で光沢がある．腹脚および尾脚は灰褐色を呈する．

3齢幼虫：頭部は淡緑色で光沢があり，上半部には黄褐色の小斑点が密集する．頭幅は約2.63mm．肉角は乳白色．前胸背板は黄緑色で光沢があり，左右両端には小さな突起がある．体色，斑紋は2齢幼虫と大差ないが，第1腹節後半部背面には1対の不明瞭な紅色紋を装うこと，同腹節の後縁の背線上に低い耳状突起が現われること，第3，4腹節の白色斑紋は2齢期よりもさらに拡がること，第2～7腹節が緑色味をおびることなどが主な相違点である．背面から見た尾端部は2齢期よりもさらに顕著に四角に張り出し，この部分の色は鮮緑色を呈する．肛上板は黄褐色で光沢がある．胸脚は淡緑褐色で光沢がある．腹脚および尾脚は灰褐色を呈する．体色には緑色型と褐色型の2型があり，Plate 2に示すのは褐色型である．緑色型はPlate 3-3に示されている．

4齢幼虫：頭部の色彩，形態は3齢期と同様である．頭幅は約3.46mm．肉角は乳白色．前胸背板は黄褐色で光沢があり，左右両端には1個の瘤状突起がある．胸部と第1腹節の上半部は黄褐色を呈し，暗褐色の小点が散在する．第3腹節の亜背線，気門上線上にはそれぞれ1個の白色の小円紋がある．第1腹節後半の背線を挟む1対の紅色紋は3齢期よりもさらに大きく，顕著となる．そしてこの2つの紅色紋の中間にX字形の黒色紋が現われ，紅色紋の内側は細楕円形の黒色紋で縁取られる．この環節の後縁の耳状突起は3齢期よりも大きい．第2～8腹節は3齢期よりもさらに強く緑色を呈し，第3，4腹節の白色紋も3齢期より大きい．第6，8，9腹節の背面は黄褐色を呈し，第8腹節背面には1個の白色の錨形紋を装う．肛上板は橙褐色で光沢がある．各節の基線は白色，尾端部分では四角く突出し，その基線部分から後縁にかけて鮮緑色を呈する．胸脚は緑褐色で光沢がある．腹脚および尾脚は灰白色を呈する．体色には緑色型と褐色型の2型があり，Plate 2に示すのは褐色型である．緑色型はPlate 3-4に示されている．

5齢幼虫：頭部は淡緑色で半光沢があり，頂部周辺がわずかに黄色味をおびる．ほぼ全域に無色の短毛を生じる．頭幅は約5.49mm．肉角は乳白色．前胸背板は鮮黄色で，その後縁は細く黒色に縁どられる．背板の左右両端には1対の短い瘤状突起がある．胴部は灰緑色で，表皮には微小な半球型の粒子が散在する(Fig. 3)．胸部はいちじるしく丸く膨らむ．第1腹節背面後半部には1個の横長の淡黄色紋があり，そのほぼ全域が細い黒色の虎斑條紋に覆われている．この黄色紋の背中線部に近く1対の黒色の三日月型紋がある．この紋に接して外側に1個の輪郭が判然としない淡紅色の円紋があり，その内部後縁に接して1個の白紋がある．第1腹節背域の後縁部は後上方に向かって強く突出する．第2腹節側面から第4腹節背面にかけて輪郭不明瞭な太い灰白色帯が斜めに走り，その一部は第5腹節前縁背線上に達する．第8腹節背域の後縁部も強く隆起する．この腹節から尾端にかけては，わずかに緑色味をおびた灰白色を呈する．体の下半部は全域灰白色である．胸脚は淡緑色，腹脚および尾脚は灰白色を呈する．

蛹：頭頂部には突起がなく，その前縁は背面から見ると浅い円弧をなして弱く扇形に拡がり，その側端は鋭く突出する．前胸および中胸背面は暗緑色を呈する．前胸背面には1個の灰色V字型隆起線があるほか，両肩部にも気門を覆う灰色の隆起紋がある．中胸背線上には1本の後倒しの嘴型突起があり，その先端は2つに分かれて尖る．突起の後面において灰色の隆起線に囲まれた部分は凹面をなして深くくぼんでいる．後胸亜背線上には1個の灰色隆起紋があり，これを出発点とする灰色隆起線は鋭角の稜線をなして前翅後縁部をふちどり，第4腹節から尾端にかけては基線上を黄色の隆起線となって縦走する．第1，2腹節背線上にはそれぞれ1個の低い瘤状突起があり，このうち第1腹節のものは前方に1個の顕著な光沢のある黒色紋を装う．第3腹節から尾端にいたる背線上には暗褐色にふちどられた1本の太い灰色帯が縦走する．第5，6，7腹節上では左右1対のよく発達した突起がこの灰色帯の外側に縦列して立ち並ぶ．これらの突起を側面から見ると，第5腹節のものは梯形，第6，7腹節のものは細長い指形で体の前方に向かって彎曲する．口吻の先端は第4腹節後縁にわずかに届かない．前脚，中脚ともにほとんど全体が露出している．前翅には多数の白色小斑点がある．腹部各節は鮮緑色で，亜背部，腹面および尾端付近は黄色味をおびる．腹面は扁平であって，葉の表面に付着する場合安定がよい．この点でも枝や葉に懸垂するために腹面が丸くても安定度に影響のない他のアゲハチョウとは著しく異なる(Fig. 5)．体長は約37mm．

幼生期生態，形態から見た本種の分類学的位置

習性

1．食餌植物はクスノキ科である．PapilioniniのうちChilasa，Agehanaの2属および北米産のPapilio troilus，P. paramedesなどがクスノキ科を食うが，これら少数の例外をのぞいて大局的に見ると，クスノキ科はLeptocirciniの主要な食餌植物である．(Leptocircini 的)
2．幼虫は歩行時に体を前後にゆすらない．(Papilionini 的)
3．幼虫は絹の台座に執着が強い．(Leptocircini 的)
4．刺激に対して肉角を積極的に出そうとしない．(特化)
5．葉の表面に蛹化する．(特化)
6．卵の孵化，終齢幼虫の生育，蛹化に長日数を要する．(特化)

形態

1．1齢幼虫

全体の色彩，斑紋とくに第2～4腹節間の白色の斜帯は*Papilio*に似る．(Papilionini 的)
頭部刺毛の数，配列は最原始型である．(Leptocircini 的) (Fig. 6)
前胸背板の輪郭が明瞭である．(Papilionini 的) (Fig. 8)
胴部背面上の突起配列はサボテン型突起が内側，常形毛が外側となっている．(Leptocircini 的) (Fig. 7)
前胸背板および胴部各部の刺毛の先端がY字型に分岐しない．(Papilionini 的) (Fig. 8)
肛上板の両外側に突起がある．(Leptocircini 的) (Fig. 9)
肛上板の輪郭が不明瞭である．(Leptocircini 的) (Fig. 9)
肉角が白色である．(特化)

2．2～4齢幼虫

頭部の刺毛は退化し，下半部だけに残存する．(特化)
胴部の突起はすべて消滅する．(特化)
胴部に小さい凹みが散在する．(特化)
全体の色彩，斑紋が*Papilio*に似る．(Papilionini 的)
胸部3節および第1腹節に水色または白色の小円紋を装う．(Papilionini 的)
第2～4腹節間の白色斜帯は*Papilio*に似る．(Papilionini 的)
肉角が白色である．(特化)
尾脚上部が鋭角に突出する．(特化)

3．終齢幼虫

前胸背板の色彩が鮮黄色である．(特化)
第1腹節背面上に帯状斑紋をもつ．(Papilionini 的)
尾脚上部が鋭角に突出する．(特化)
肉角が白色である．(特化)
胴部表皮に微小な半球型粒子が散在する．(特化)

4．蛹

頭頂部に突起がない．(Leptocircini 的) (Fig. 4)
中胸部背面の突起が後方を向く．(特化)
同上突起の先端が分岐する．(特化)
同上突起の後側に深い凹みがある．(特化)

腹部背面上の突起は1齢幼虫背面のD1突起の再現であり，一般のPapilioniniにおけるようにD2の再現ではない．(特化) (Fig. 5)
触角，胸脚の現われ方．(Papilionini 的)
第4腹節～尾端間の腹面側は平面をなす．(特化)

結　　論

以上述べてきた幼生期の習性や形態を考える時，幼生期の初期においてはPapilioniniまたはLeptocirciniと共通の多くの特徴をもつが，これらの形質の中にはこれら2族以外の族にも存在するものがあり，本種がこれら2族のいずれかに属さねばならないとは言いがたい．

幼虫が成長するにしたがって，これら2族に見られない独自の形質が増加し，蛹の形態にいたってはまったくこれら2族および他の諸属との共通性が見出せなくなる．

つまりこの種は幼生期の形態に基づくかぎり，PapilioniniとLeptocirciniがその共通の祖先から分岐する以前に主幹から分岐発生した別の族であって，PapilioniniにもLeptocirciniにも属するものではないと考えられる．

属*Meandrusa*の他の1種*sciron*については1齢幼虫だけを検する機会に恵まれたが，これも本種とまったく同型であった．

Plate 1.

Meandrusa payeni ciminius FRUHSTORFER (×1.00)

Above: Male Cameron Highlands, MALAYSIA. November 11, 1986

Below: Female do October 4, 1986

Plate 2. Immature stages of *Meandrusa payeni ciminius* (BOISDUVAL)

0. Egg
1. First-instar larva
2. Second-instar larva
3. Third-instar larva
4. Fourth-instar larva
5. Fifth-instar larva
    a. Dorsal and lateral aspect
    b. Larval head skulls
    c. Osmeteria

P. Dorsal and lateral aspect of pupa

O
1 a
1 b
1 c
2 b
2 c
2 a
3 c
3 b
4 c
3 a
4 b
5 c
5 b
4 a
P
5 a
S. Igarashi
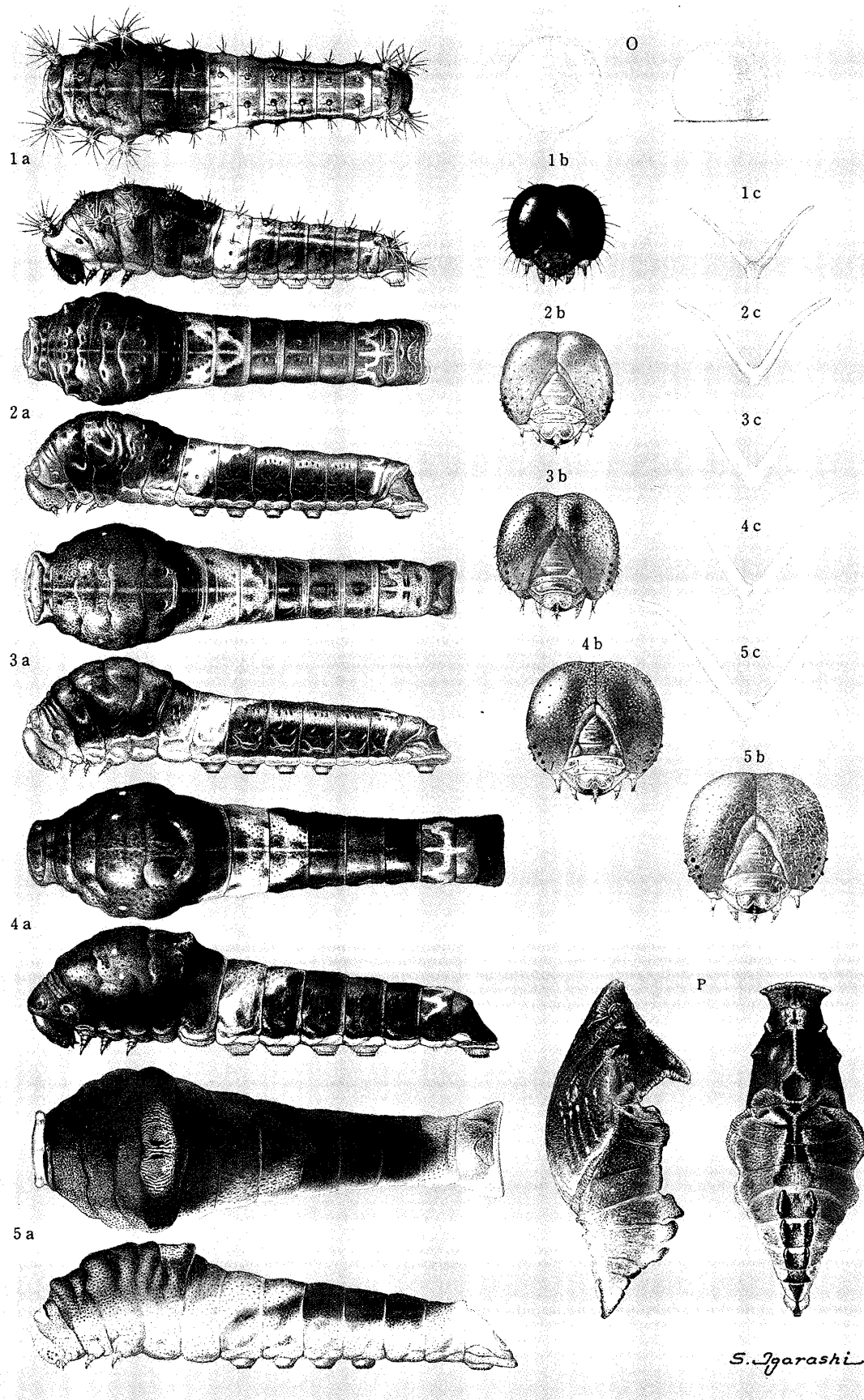
Plate 3.

1. Wild egg *in situ* (June 26th, 1987, Malaysia)
2. First-instar larva
3. Third-instar larva (green type)
4. Fourth-instar larva (green type)
5. Fifth (final) instar larva
6. Fresh pupa on foodplant leaf
7. Empty pupal case found in the wild (June 26th, 1987)
8. Foodplant : *Litsea cubeba* (LOUR.) PERS. (Lauraceae)
9. Leaf
10. Fruits
11. Sprig

1
2
3
4
5
6